DEGREE CURRICULUM

ORGANIC CHEMISTRY AND BIOCHEMISTRY

Coordination: MORALEJO VIDAL, MARIA DE LOS ANGELES

Academic year 2022-23

ORGANIC CHEMISTRY AND BIOCHEMISTRY 2022-23

Subject's general information

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<tr><td>Subject name</td><td>ORGANIC CHEMISTRY AND BIOCHEMISTRY</td></tr>
<tr><td>Code</td><td>102209</td></tr>
<tr><td>Semester</td><td>2nd Q(SEMESTER) CONTINUED EVALUATION</td></tr>
<tr><td>Typology</td><td>
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<tr><th>Degree</th><th>Course</th><th>Character</th><th>Modality</th></tr>
<tr><td>Bachelor's Degree in Food Science and Technology</td><td>1</td><td>COMMON/CORE</td><td>Attendance-based</td></tr>
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<tr><td>Course number of credits (ECTS)</td><td>6</td></tr>
<tr><td>Type of activity, credits, and groups</td><td>
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<tr><th>Activity type</th><th>PRALAB</th><th>PRAULA</th><th>TEORIA</th></tr>
<tr><td>Number of credits</td><td>0.8</td><td>1</td><td>4.2</td></tr>
<tr><td>Number of groups</td><td>6</td><td>2</td><td>1</td></tr>
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<tr><td>Coordination</td><td>MORALEJO VIDAL, MARIA DE LOS ANGELES</td></tr>
<tr><td>Department</td><td>CHEMISTRY</td></tr>
<tr><td>Important information on data processing</td><td>Consult this link for more information.</td></tr>
<tr><td>Language</td><td>50% Catalán
50% Castellano</td></tr>
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ORGANIC CHEMISTRY AND BIOCHEMISTRY 2022-23

Teaching staff	E-mail addresses	Credits taught by teacher	Office and hour of attention
CANELA GARAYOA, RAMON	ramon.canela@udl.cat	3,7	
DAVID , CALIN ADRIAN	calinadrian.david@udl.cat	1,2	
LARA AYALA, ISABEL	isabel.lara@udl.cat	1,2	
MORALEJO VIDAL, MARIA DE LOS ANGELES	marian.moralejo@udl.cat	4,9	

Subject's extra information

PERSONAL PROTECTIVE EQUIPMENT (PPE) for the practical sessions

It is **MANDATORY** that students have the following personal protective equipment (PPE) in the course of teaching practices.

- Laboratory coat UdL unisex
- Safety glasses
- Chemical / Biological protection gloves

The PPE can be purchased at UdL's ÚDELS store

Center for Cultures and Cross-Border Cooperation - Cappont Campus

Carrer de Jaume II, 67 low

25001 Lleida

http://www.publicacions.udl.cat/

For more information, check the product listings: http://www.biotecnologia.udl.cat/en/pla-formatiu/equipament.html

For other protection equipment (for example, caps, respiratory masks, etc.), they will depend on the type of practice to be performed. In this case, the responsible professor will inform if the use of these specific PPE is necessary.

Not carrying the PPE described or not complying with the general security regulations detailed below will mean that the student can not access the laboratories or have to leave the same.

GENERAL SAFETY RULES IN LABORATORY PRACTICES

- Maintain the place of performance of clean and tidy practices. The work table must be free of backpacks, folders, coats ...

- In the laboratory you can not come with shorts or short skirts.
- Bring closed and covered shoes during the performance of the practices.
- Bring long hair always collected
- Keep the cords fit to protect against spills and spills of chemical substances.
- Do not carry wide bracelets, pendants or sleeves that can be trapped by the equipment, assemblies ...
- Avoid wearing contact lenses, since the effect of chemicals is much greater if they are introduced between the contact lens and the cornea.
- Do not eat or drink in the laboratory
- Smoking is prohibited within laboratories
- Wash your hands whenever you have contact with a chemical and before leaving the laboratory.
- Follow the teacher's instructions and consult any questions about security

Learning objectives

Learning objectives

Knowledge objectives:
It is a first-year subject, with basic training in the fundamentals of organic chemistry and biochemistry, both from a structural and reactivity point of view. The knowledge acquired should allow the student to understand the concepts of isomerism related to organic compounds and to chemically interpret the biochemical processes that will be seen later in other subjects of the degree.

More specifically, the objectives of the course are:
• Achieve knowledge and understanding of the basic concepts of the various binding theories applicable to organic compounds.
• Know the basic organic nomenclature, recognize functional groups and the main associated properties.
• Be able to describe and understand the different types of isomerism of organic compounds.
• Be able to identify and describe the reactivity and reaction mechanisms of the main organic reactions, as well as the various factors that affect them.
• Know the structural bases that explain the function of the main biological macromolecules: carbohydrates, lipids, proteins, enzymes and nucleic acids.

Competences

Basic Competences

CB1. That students have demonstrated to possess and understand knowledge from the base of general secondary education at a level that, while supported by advanced textbooks, also includes some aspects that involve knowledge from the forefront of their field of study .

CB2. That students know how to apply their knowledge to their work or vocation in a professional way and possess the competencies that are usually demonstrated through the elaboration and defense of arguments and the resolution of problems within their area of study.

CB3. That students have the ability to gather and interpret relevant data (usually within their area of study) to make judgments that include reflection on relevant issues of a social, scientific or ethical nature.

CB4. That students can transmit information, ideas, problems and solutions to both specialized and non-specialized audiences

CB5. That students have developed those learning skills necessary to undertake further studies with a high degree of autonomy

General Competences

CG1. Analyze specific situations, define problems, make decisions and implement action plans in search of solutions.

CG2. Interpret studies, reports, data and analyze them numerically.

CG3. Select and manage the available written and computerized sources of information related to the professional activity.

CG4. Work alone and in a multidisciplinary team.

CG5. Understand and express themselves with the appropriate terminology.

CG6. Discuss and argue in various forums.

CG7. Recycle in new technological advances through continuous learning.

CG8. Value comprehensive training, personal motivation and mobility.

CG9. Analyze and assess the social and ethical implications of professional activity.

CG10. Have a critical and innovative spirit.

CG11. Analyze and assess the environmental implications in professional activity

Subject contents

THEORETICAL AGENDA

1. Introduction (7 h).

Object of Organic Chemistry and Biochemistry. Links in Organic Chemistry. Lewis theory. Rules of structural chemistry. Formal charge. Resonant structures. Theory of repulsion of electron pairs. Intermolecular forces in Organic Chemistry. Functional groups and Classes. Chemical radical.

3. Isomerism (9 h).
Isomers. Types of isomers. Structural isomers. Stereoisomers. Optical isomers. Optical activity. Racemic mixtures. Representation of stereoisomers. Absolute configurations R, S. Relative configurations D, L. Diastereoisomers. Meso forms. Geometric stereoisomers of cycles and double link. Conformational analysis.Formers in acyclic compounds and in cyclic compounds.Newman's projections.

3.- Basic physical-chemical properties (5 h).

As the characteristics and structure of molecules are useful to explain properties of matter such as its physical state at different temperatures and its solubility. Application to the most important classes within organic chemistry: hydrocarbons, halogenated derivatives, alcohols, ethers, amines, aldehydes, ketones, carboxylic acids and derivatives thereof

4. Chemical kinetics (7 h).

Reaction speed concept. Reaction rate constant. Order of reaction. Median life time concept. Study of processes with kinetics of order 0, 1 and 2. Systems to determine the order of a reaction. Mechanism of reactions. Stages of a reaction. Transitional and intermediate state. Activation energy. Effect of temperature on the rate of the reaction. Arrhenius Law. Effect of the catalyst on the rate of the reaction.

5.-Basic concepts of chemical reactivity (9 h).

How the characteristics and structure of molecules are useful to explain the reactivity of substances. Homolytic and heterolytic breaking and opening of chemical bonds. Types of reactions according to the exchanges of atoms and bonds that take place: isomerization reactions, substitution reactions, addition reactions, elimination reactions, redox reactions. Concept of radical, nucleophile and electrophilic center. Application to the most important classes within organic chemistry: hydrocarbons, halogenated derivatives, alcohols, ethers, amines, aldehydes, ketones, carboxylic acids and derivatives thereof.

6. Carbohydrates (4 h).

Characteristics. Monosaccharides. Classification. Properties. Monosaccharide cyclization. Mutarotation. Derivatives formation. Glycosidic bond. Disaccharides. Types. Nomenclature. Polysaccharides: characteristics and types.
Homopolysaccharides and heteropolysaccharides. Glucoconjugates.

7. Amino acids, peptides and proteins (4 h).

Protein amino acids. General structure. Classification. Properties. Chirality. Amphoteric character. Dissociation equilibria. Isoelectric point. Henderson-Hasselbach equation. Peptide bond. Structure and properties. Oligo- and polypeptides. Fibrous and globular proteins. Structural levels. Primary, secondary, tertiary and quaternary structure. Forces involved in the stability of protein structures. Native conformations. Denaturation.

8. Enzymes (4 h).

Definition, properties and classification. Apoenzyme and holoenzyme. Concept of cofactor, coenzyme, cosubstrate and prosthetic group. Active center. Definition and properties. Michaelis-Menten kinetics. Lineweaver-Burk transformation. Activation and inhibition of enzymatic activity. Dependence of pH and temperature. Denaturation of enzymes. Irreversible inhibitors. Reversible inhibitors. Competitive inhibitors. Non-competitive inhibitors. Uncompetitive inhibitors.

9. Lipids (2 h).

Characteristics. Fatty acids. Nomenclature. Structure and properties. Saponifiable lipids: structures, types and properties. Unsaponifiable lipids: structures, types and properties. Supramolecular structures.

10. Nucleic acids (2 h).

Nucleosides and nucleotides. Structure. Functions. Oligo- and polynucleotides. Structure. Phosphodiester bond. DNA. Structure. Forces involved in its stabilization. Functions. RNA. Structure. Major types: mRNA, tRNA, rRNA. Features and functions.

PRACTICAL ACTIVITIES

Laboratory practices

Practice 1: Use of Molecular Models (2 h).

Basis. Construction of organic molecules through molecular models. Conformation studies. Stereoisomer studies. Enantiomers. Diastereoisomers. Meso forms.

Practice 2: Extraction procedures (2 h).

Basis. Solid-liquid extraction and liquid-liquid extraction. Applications in mixture separation: Separations based on pH, separations based on polarity.

Practice 3: Separation processes (fundamentals of chromatography) (2 h).

Basis. Thin layer chromatography. Applications. Qualitative analysis of ergosterol.

Practice 4: Titration of amino acids (2 h).

Basis. Construction of titration curves of a basic amino acid. Buffering capacity. PKas and Isoelectric point.

Problem seminars (10 h):

Sessions in small groups where the main concepts seen in the theory classes will be reinforced by solving problems and multiple choice questions. They will essentially understand aspects of Lewis Theory of organic compounds, concept and type of isomers, chemical reactivity and kinetics, amino acid dissociation equilibria, enzyme kinetics. Isomerism and types of bonds in Carbohydrates

Methodology

Methodological axes are:

• Master classes of theory.
• Classes of problems and questions in small groups.
• Laboratory practices in small groups with the aim of expanding theoretical knowledge and knowing the handling of material and basic laboratory techniques.

Development plan

ype of activity	Description	Student Face-to Face Activity		Student non face-to -face activity		Evaluation	Total time	
		Objetivs	Hours	Student work	Hours	Hours	Hours	ECTS
Theory	Master class (Classroom. Large group)	Explanation of the main concepts	42	Study: know, understand and synthesize knowledge	59	3	83	4
Problems and cases	Participatory class (Classroom. Small groups)	Troubleshooting and cases	10	Learn to solve problems and cases	21	2	45	1.5
Laboratory	Laboratory practices (Small groups)	Execution of the practice, understand phenomena, measure….	8	Execution of the practice, understand phenomena, measure….	4	1	22	0.5
Totals			60		84	6	150	6

Evaluation

The **FINAL QUALIFICATION** will come from three sources:

1. Mark of a written test of theory and problems of the **first partial (40%).**
2. Mark of test resolution on-line **(10%)**
3. Mark of a written test of theory and problems of the **second partial (40%).**
4. **Laboratory practices (10%)**, resulting from the qualification of a written test and the assessment of the student's achievement and behavior in the laboratory.

IMPORTANT:
Attendance at the 4 internship sessions will be mandatory and an indispensable requirement to pass the course.
Students who have completed all 4 internships in previous courses will be able to choose between different options:

- Repeat the practices and the exam (the note of previous courses will be discarded).
- Repeat only the exam (the note of previous courses will be discarded).
- Do not repeat the internship or the exam and keep the grade of previous courses.

EVALUATION:

The evaluation of the subject can be continuous or unique:
1. In order to pass the subject in the mode of **continuous evaluation**, the weighted sum of the marks of the first part, second part and practices must give a **final grade equal to or greater than 5 out of 10**.
IMPORTANT:
To pass the subject, a **minimum grade of 4 out of 10 will be required in each of the two partials.**
Students who have not passed the subject globally in the first call, but have a partial pass, will be able to choose between:

- Maintain the mark of the approved part and be examined in the second call only of the suspended part **(recovery exams).**
- Examination of both parties in the second call **(recovery exams).**
- In the event of taking the resit exams, the mark obtained in the first call will be discarded.
- The mark of the practice exam will not be recoverable.

2. Students who do NOT opt for continuous assessment will be entitled to a **single final exam**, with content of theory and practice:
• This single exam will represent **100% of the final grade.**
• Students who have done the internship in a previous year may choose not to take the internship part of this final exam. In this case, the grade obtained in the last year in which they took the internship exam will be taken into account.

Bibliography

Organica Chemistry

- Hart H, Hart DJ, Craine LE (1995). Química Orgánica. McGraw Hill.
- Mc Murray J. (1994). Química Orgánica. Addison-Wesley Iberoamericana.
- Bruice PY (1998). Organic Chemistry. Pretice Hall.
- Allinguer NL, Cava MP, De Jongh DC, Johnson CR, Lebel NA, Stevens CL (1988). Química Orgánica. Reverté.
- Dept. Química – UdL. Química Orgànica. Problemes Resolts. (2007) Ed. Universitat de Lleida.

Biochemistry

- Nelson DL, Cox MM. (2018). Lehninger, Principios de Bioquímica. 7ª edición. Ed. Omega
- Feduchi E, Blasco I, Romero CS, Yáñez E. (2021). Bioquímica, Conceptos esenciales. 3ª edición Ed. Médica Panamericana,

Others

- Morrison RT, Boyd RN (1990). Química Orgánica. Addison-Wesley Iberoamericana.
- Solomons TW, Grahan (1998). Fundamentos de Química Orgánica. Limusa. México.
- Vollhardt, KP, Schore, NE (1996). Química Orgánica. 2ª edición, Ed. Omega
- Wade L.G. (1993). Química Orgánica. Prince Hall Hispanoamericana. México.

- Stryer L, Berg JM, Tymoczko JL (2014). Bioquímica. Curso Básico Ed. Reverté
- Voet D, Voet JG, Pratt CW (2016). Fundamentos de Bioquímica. La vida a nivel molecular. 4ª ed. Ed. Médica Panamericana.